

PLASTIC INJECTION NOZZLE FOR BOTTOM INJECTION CHILLING

SPECIFICATION

[0001] The present embodiments relate to apparatus used to introduce cryogenic substances into chillers, blenders, kettles or mixers (mixing tanks) in which a product such as a food product is being processed.

[0002] Known chillers, blenders, kettles or mixers (collectively "chillers") consist of a large vessel, container or drum in which a plurality of metallic nozzles are used to introduce a cryogenic substance, such as liquid carbon dioxide or liquid nitrogen, from a remote source of said cryogen into the chiller. The nozzles are attached to conduits or piping, some of which is flexible, from the source, but which are usually exposed to the plant or facility atmosphere being at ambient temperature and certainly a temperature higher than the cryogenic substance being introduced into the chiller. Accordingly, the extreme cold of the cryogen is conducted through the wall of the nozzle and the conduit to be in contact with the atmosphere of the plant which results in frosting and large amounts of ice build-up at the nozzles, conduit and exterior wall of the chiller where the metallic nozzle(s) penetrate the chiller wall. This excessive amount of ice and snow build-up can, over time, compromise the structural integrity of the equipment, clog the nozzles, lead to food product excessively sticking to nozzles and the chiller wall, and lead to an unusually long warm-up period after the cryogenic substance is no longer being introduced into the chiller. That is, upon cessation of chilling operations, an unacceptable period of time is required for known nozzles to become warm enough for the ice and snow build-up to be removed should maintenance and repair have to occur for the nozzles, conduits or chiller.

[0003] In addition, an inner metallic surface of the chiller or the chiller wall which has been cooled by known metallic nozzles will cause product to freeze to the wall surface and create interference between the product frozen to the wall and paddles or blades of the mixer, thereby damaging the paddles and also damaging the product by pulverization. Scraped surface type mixers are also susceptible to damage if a large layer of ice is formed at the nozzle in the interior of the mixer such that agitators for the mixer contact the ice layers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] For a more complete understanding of the present embodiments, reference may be had to the following description taken in conjunction with the drawing Figures, of which:

[0005] FIG. 1 shows a side plan exploded view partially in cross-section of the injection nozzle according to the present embodiments;

[0006] FIG. 2 shows a top plan exploded view of the injection nozzle of FIG. 1;

[0007] FIG. 3 shows a top plan view of a plastic portion of the embodiment of FIG. 2; and

[0008] FIG. 4 shows the injection nozzle of FIG. 1 mounted to a side wall of a chiller for operation.

DETAILED DESCRIPTION OF THE INVENTION

[0009] Referring to FIGS. 1-3, a plastic injection nozzle apparatus of the present embodiments is shown generally at 10 to deliver liquid nitrogen or liquid carbon dioxide.

[0010] The injection nozzle apparatus 10 includes a plastic nozzle 12 having by way of example a substantially cylinder shape, or circular cross-section. Plastic nozzle 12 can be formed from teflon, ultra high molecular weight (UHMW) plastic or other type of plastic material. One end of the nozzle is provided with a metallic threaded portion 14 for being releasably engaged with another component as described hereinafter. An opposite end of the nozzle 12 has a facial portion 16 cut at an angle as shown more clearly in FIGS. 2-3. The plastic nozzle is formed with a central bore 18 extending therethrough from the metallic threaded portion 14 to proximate the facial portion 16. A section of the plastic nozzle 12 is provided with a flange 20 or alternatively a metallic or plastic washer instead of the flange for a purpose to be described hereinafter.

[0011] The central bore 18 terminates within the plastic nozzle at a plurality of channels 22 shown more clearly in FIGS. 2-3. The channels 22 terminate in a corresponding number of apertures 24 or holes at the facial portion 16 of the plastic nozzle 12. The apertures 24 are arranged at the facial portion 16 in a dispersing pattern to subscribe an arc of, by way of example, 60 degrees. That is, a central one of the apertures 24 which is in communication with the central bore 18 is aligned essentially with a central longitudinal axis 26 of the nozzle 12. The apertures 24 at either side of the central aperture are correspondingly angled outward as shown in particular in FIG. 3 so that the cryogenic substance is dispersed over a field which, during dispersion, represents a fan-shaped swath for contacting the food product in the chiller.

[0012] A finger 28 or tongue constructed of the same materials as the plastic nozzle 12 or of stainless steel extends from the washer 20, for a purpose to be described hereinafter.

[0013] A housing 30 of stainless steel is provided to function as a sheath for the plastic nozzle 12. The sheath 30 includes an interior space 32 sized and shaped to receive the plastic nozzle 12. One end of the sheath is provided with an exterior threaded portion 34 to be releasably engagable with another component of the apparatus as described hereinafter. Another end of the sheath 30 is provided with an angularly cut facial portion 36 which is open-ended such that the facial portion 16 of the plastic nozzle 12 can be exposed at the facial portion 36 and if necessary slightly extend therefrom. A groove 35 or receptacle is formed in the threaded portion 34 of the sheath 30, for a purpose to be described hereinafter.

[0014] When the plastic nozzle 12 is disposed in the space 32 of the sheath 30, a nut 38 is used to be threadably engaged with the threaded portion 34 of the sheath to thereby releasably mount the plastic nozzle in the interior space 32 of the sheath. The threaded portion 14 of the plastic nozzle 12 will extend beyond the nut 38 for releasable engagement as described hereinafter.

[0015] In order to align the facial portion 16 of the plastic nozzle 12 to be in registration with the facial portion 36 of the sheath 30, the finger 28 is received in the groove 35 when the plastic nozzle 12 is slid into the interior space 32 of the sheath 30. This tongue-in-groove arrangement insures that the facial portions 16,36 are in registration for mounting the injection nozzle apparatus 10 as shown in FIG. 4. Even if one were to insert the plastic nozzle 12 into the interior space 32 such that the facial portions 16,36 were not in alignment, then merely rotating

the plastic nozzle 12 while it is in the interior space 32 and applying pressure to the nozzle so that upon registration of the finger 28 with the groove 35 the nozzle 12 will slip into position and be seated so that the facial portions 16,36 are in registration. Once the plastic nozzle is seated in the interior space 32 of the sheath 30, the nut 38 can be threaded down to the threaded portion 34 until such time as the flange 20 is seated securely within the nut 38.

[0016] A delivery tube 40 constructed of stainless steel has a bore 42 or passageway extending therethrough. Both ends of the bore are open-ended with a length of the delivery tube 40 sized and shaped to be received within the central bore 18 of the plastic nozzle 12. When such occurs, the bore 42 is in registration with the central bore 18. One end of the delivery tube 40 is provided with a nipple 44 to be received by and seated into a flexible conduit from which the liquid cryogen is provided. A flexible hose 46 or conduit has a passageway 48 extending therethrough and through which liquid cryogen is provided from a remote source (not shown). One end of the flexible hose 46 is provided with a stainless steel receptacle 50 in communication with the passageway 48 and sized and shaped to receive the nipple 44 of the delivery tube 40. A stainless steel nut 52 is used to be threadably engaged with the metallic threaded portion 14 of the plastic nozzle. Accordingly, liquid cryogen can flow through the passageway 48 into the bore 42 and through the channels 22 to be exhausted from the apertures 24 into a mixer 60 as shown in FIG. 4.

[0017] Referring to FIG. 4, the plastic nozzle apparatus 10 is shown assembled and mounted for use with the mixer 60. The flange 20 provides a surface for the nut 38 to bear against when it is threadably engaged to the threaded portion 34 of the sheath 30. The plastic flange provides a plastic thermobreak surface between the metallic nut 38 and metallic threaded portion 34. The liquid cryogen may be introduced into the flexible hose 46 from a stand

pipe 54 or manifold constructed and arranged external to the mixer 60. As shown in FIG. 4, the liquid cryogen transiting through the passageway 42 of the delivery tube 40 and then through the channels 22 becomes exposed to the warmer contents in a chamber 62 of the mixer 60 so that some of the liquid cryogen flashes resulting in liquid, solid and gaseous phases of the cryogen being disbursed in a spray pattern within the chamber 62. The facial portion 16 having the plurality of apertures 24 is exposed to the chamber 62 of the mixer 60.

[0018] The sheath 30 being constructed of stainless steel is disposed through a hole 64 or port formed in a side wall 66 of the mixer 60. The side wall 66 defines the chamber 62 and includes an outer surface 61 and an inner surface 63. The sheath 30 is accordingly welded to the outer and inner surfaces 61,63 of the side wall 66 where it is introduced therethrough to form a seal at the side wall. A perimeter 68 or edge of the facial portion 36 of the sheath 30 can be formed, such as by grinding, to conform substantially to the inner surface 63 of the side wall 66. Such construction substantially reduces if not elements areas where product in the chamber 62 can become trapped and accumulate.

[0019] The plastic nozzle 12 substantially functions as a thermobreak and reduces if not eliminates the conduction of the extreme cold of the liquid cryogenic substance from causing ice and snow build-up at an exterior of the sheath 30, the facial portion 16 of the nozzle 12, and the side wall 66 of the chiller.

[0020] The plastic nozzle 10 of the present embodiments will substantially reduce if not eliminate extreme cold from the liquid nitrogen or liquid carbon dioxide being conducted from the pipeline or conduit to the chiller wall and reduce if not substantially eliminate food products in the chiller from sticking or

adhering to the nozzle and the blender wall. This results in a more uniform temperature distribution through the food products in the mixer 60.

[0021] In addition, the plastic nozzle 10 will substantially reduce the chances of the chiller wall from being distorted or deflecting from the extreme cold temperatures of the cryogenic substance. Liquids in the mixer 60 will be prevented from freezing to the nozzle due to the plastic composition of same, and in that regard, food product in the mixer will not stick to the apertures 24 of the nozzle due to the plastic construction. The absence of ice build-up will prevent damage to the chiller agitators, whether some are paddle-type, ribbon-type or plastic scraped surface-type. This also results in improved hygiene with respect to the nozzle and as mentioned above, permits the nozzles to thaw faster upon cessation of chilling operations and to be removed from the sheath 30 for cleaning, maintenance and repair.

[0022] It will be understood that the embodiments described herein are merely exemplary, and that one skilled in the art may make variations and modifications without departing from the spirit and scope of the invention. All such variations and modifications are intended to be included within the scope of the invention as described and claimed herein. Further, all embodiments disclosed are not necessarily in the alternative, as various embodiments of the invention may be combined to provide the desired result.

CLAIMS

What is claimed is:

1. An injection nozzle, comprising:

a plastic body portion having a first end and a second end opposed to the first end;

a passageway extending through the plastic body portion and having a first opening proximate the first end and a second opening at the second end; and

a plurality of channels in communication with the first opening, each one of the plurality of channels terminating in a corresponding aperture at the first end.

2. The injection nozzle of claim 1, wherein the first end comprises an angled plastic facial portion in which the corresponding apertures are disposed.

3. The injection nozzle of claim 1, further comprising a finger disposed and protruding from the second end of the plastic body portion.

4. The injection nozzle of claim 3, further comprising a metallic housing having a sidewall defining an open ended space therein sized and shaped to receive the plastic body portion, and a groove disposed to be in registration with and receive the finger to removably mount the plastic body portion in the interior space.

5. The injection nozzle of claim 4, wherein the metallic housing comprises a threaded portion at the sidewall for being releasably engaged to a mechanical fastener.
6. The injection nozzle of claim 1, wherein the plurality of channels are arranged in a dispersing pattern from the first opening.
7. The injection nozzle of claim 1, wherein the plastic body portion comprises a threaded portion at the second end for being releasably engaged to a mechanical fastener.
8. The injection nozzle of claim 1, wherein the first end of the plastic body portion comprises an angled plastic facial portion in which the corresponding apertures are disposed, and further comprising a metallic housing having a sidewall defining an open ended space therein sized and shaped to receive the plastic body portion, the sidewall having an angled metallic facial portion in registration with the angle plastic facial portion.